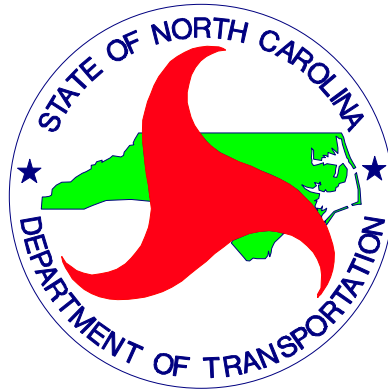
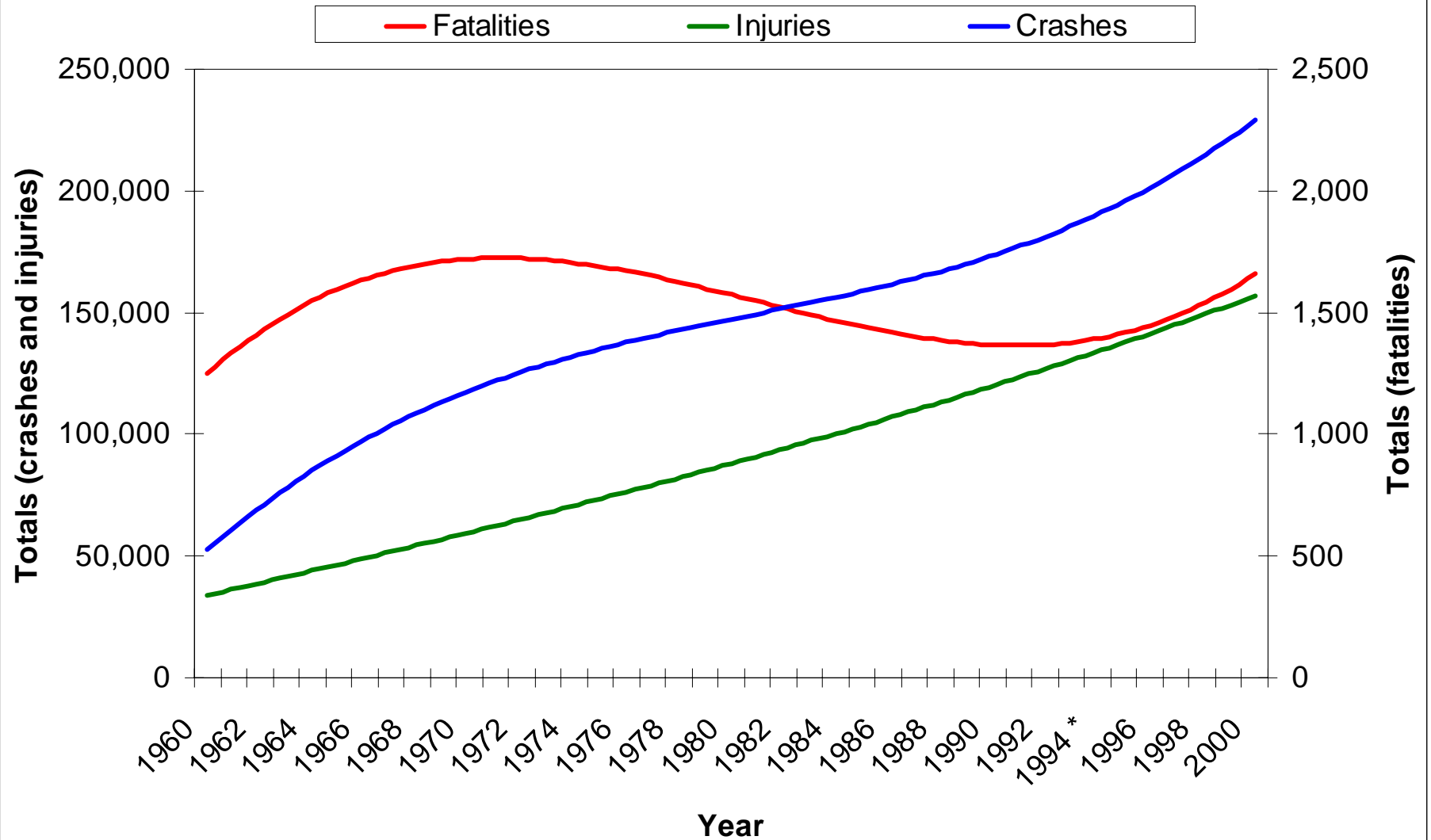


Guidelines for the Investigation and Remediation of Potentially Hazardous Bicycle and Pedestrian Locations

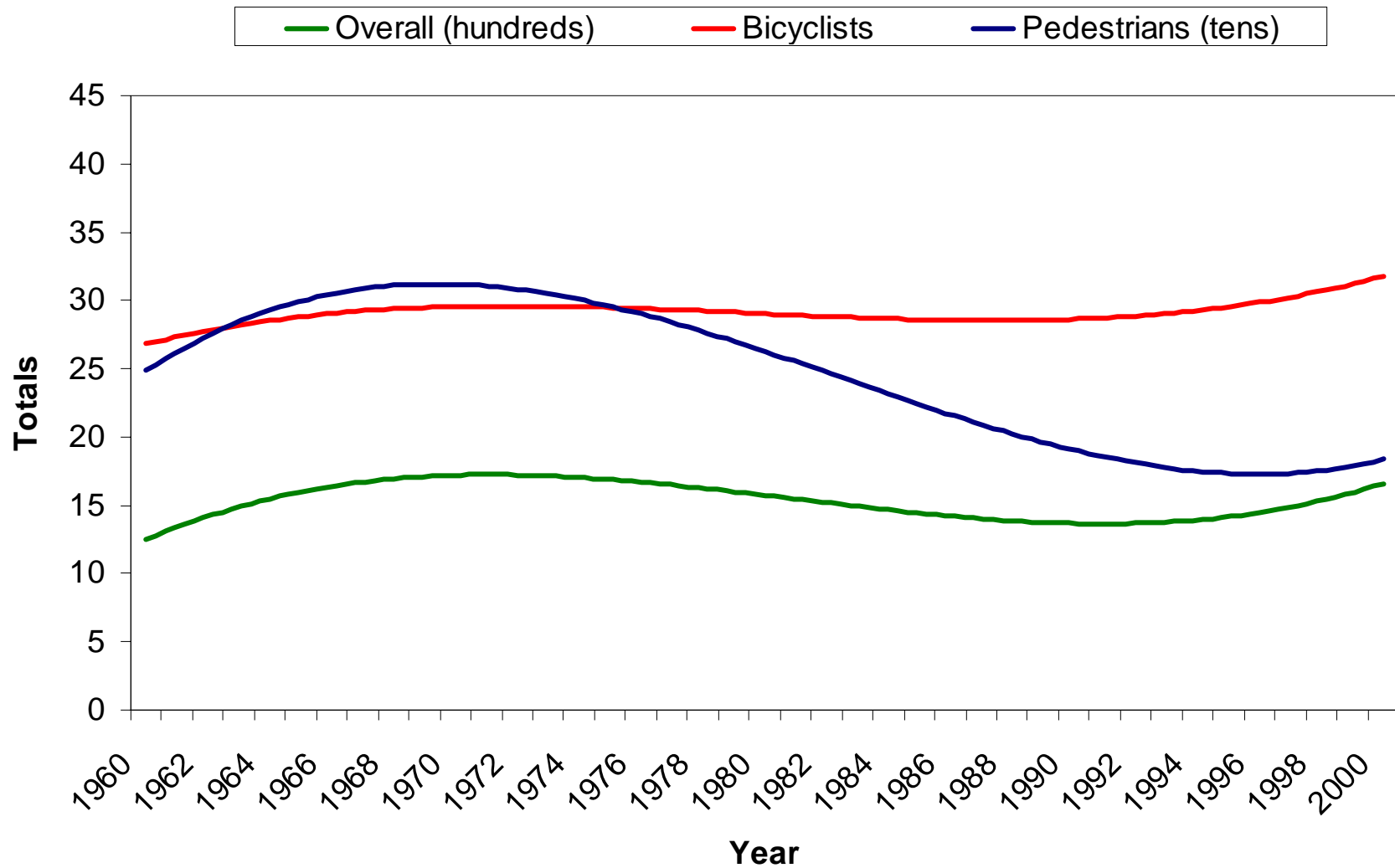


R.J. (Jeff) Jaeger, PE
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Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation
May 2003

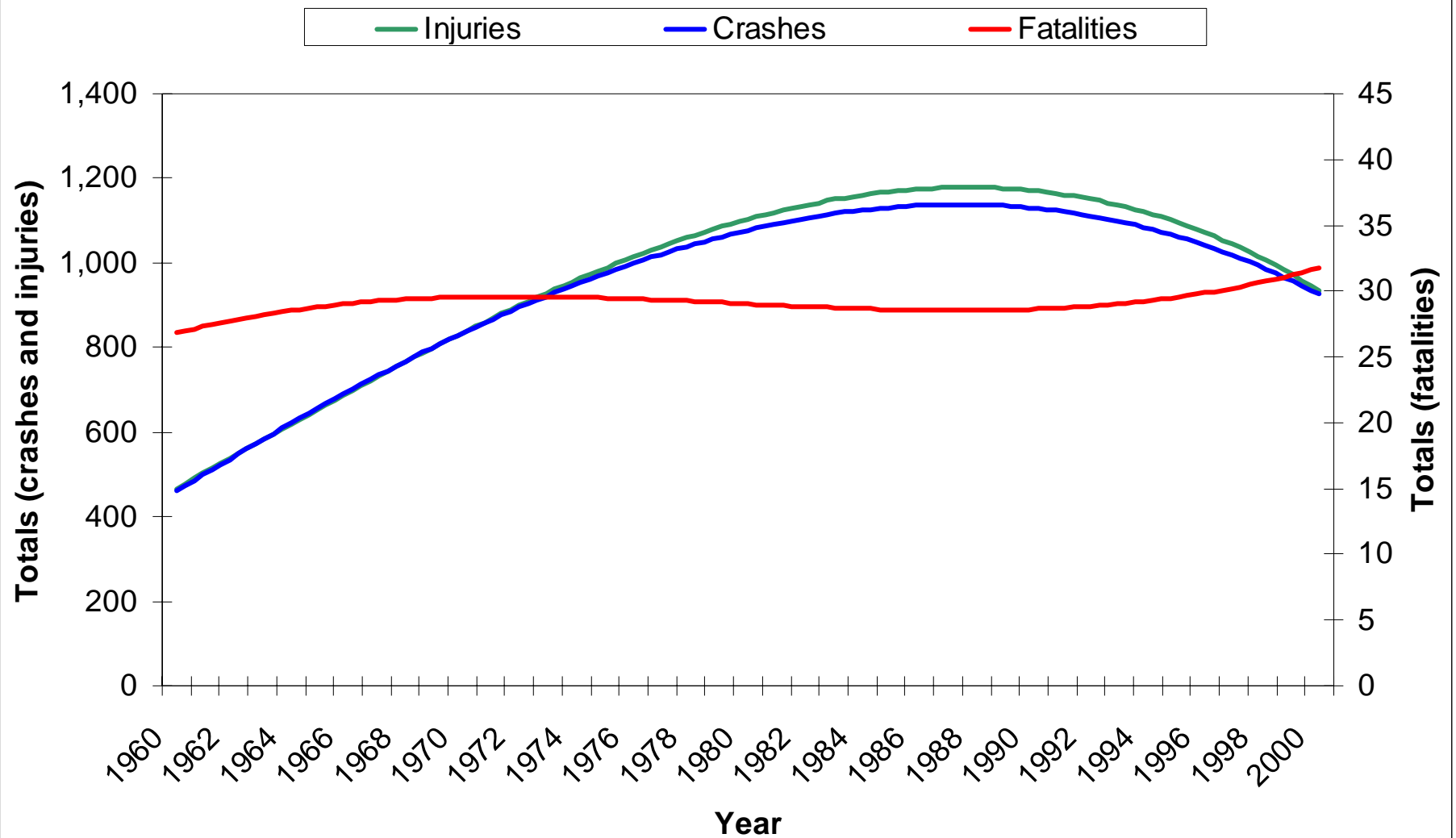
North Carolina Traffic Crashes - General Trends (1960 - 2000)



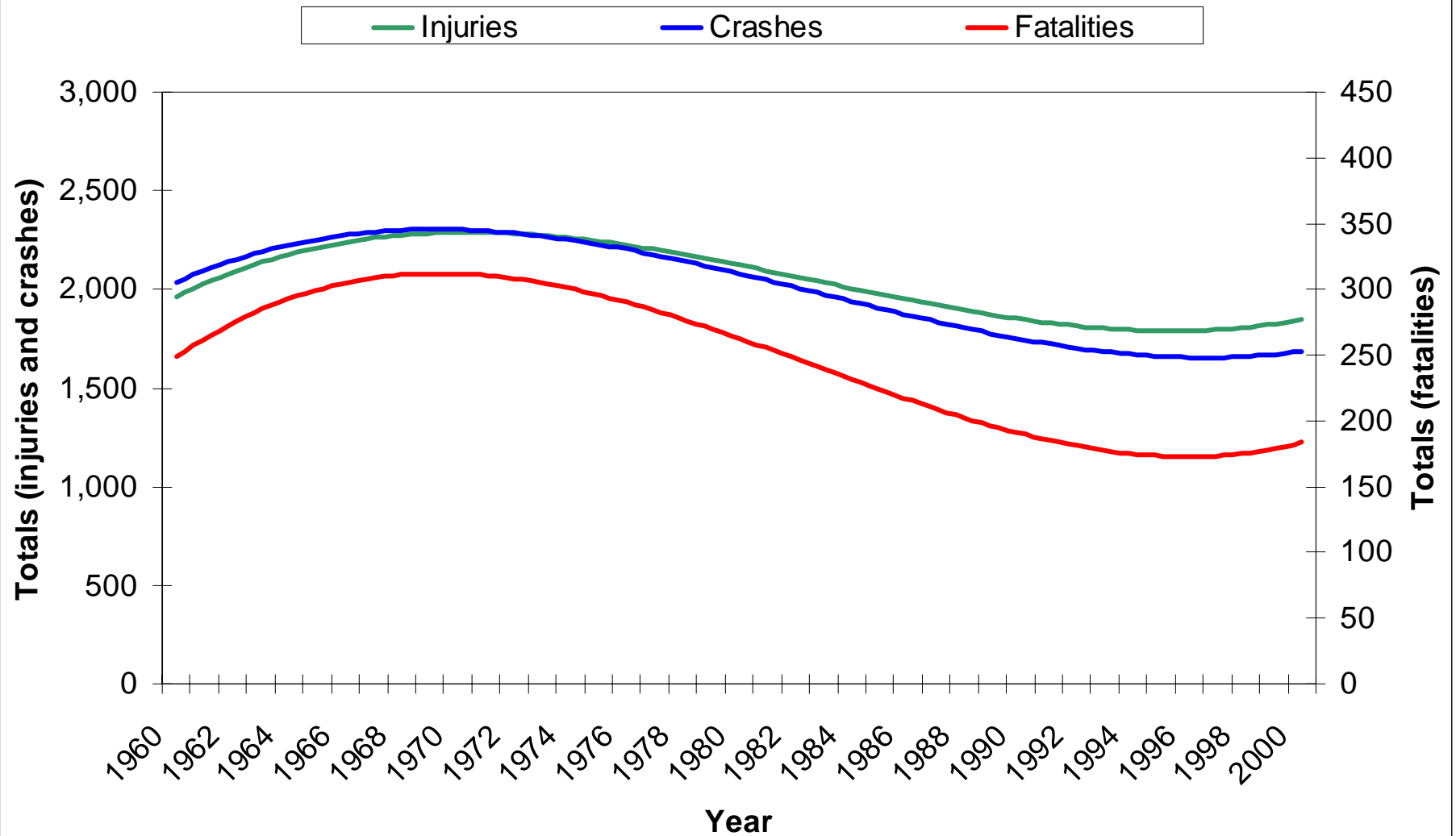
North Carolina Traffic Fatalities - General Trends (1960 - 2000)



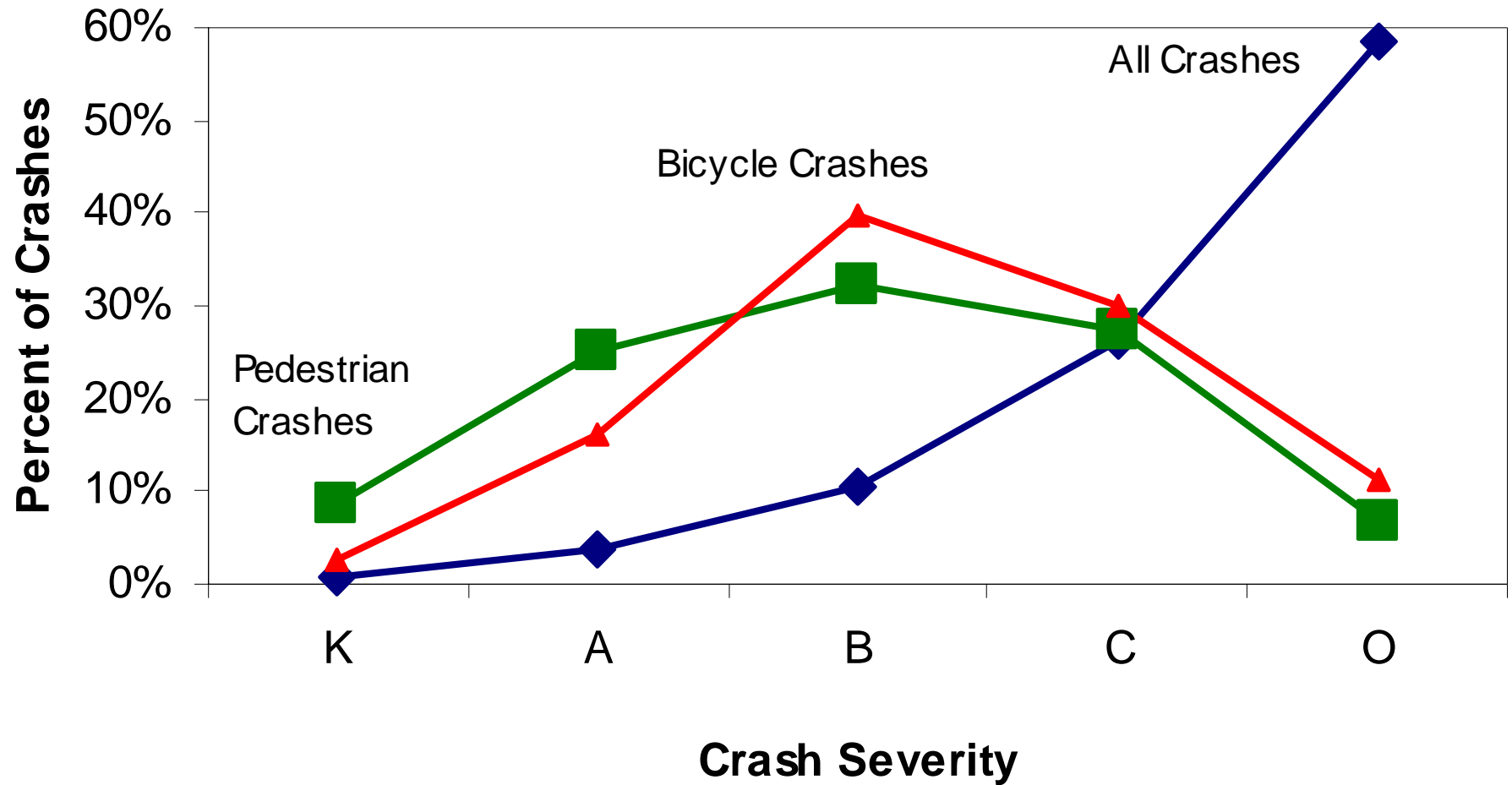
North Carolina Bicycle Crashes - General Trends (1960 - 2000)



North Carolina Pedestrian Crashes - General Trends (1960 - 2000)



Crash Severity Breakdown (1991-2000)



**North Carolina
BICYCLE AND PEDESTRIAN
SAFETY STUDY**



September 1999



Traffic Safety Systems Management Unit
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation

R.J. (Jeff) Jaeger, EI



**North Carolina
Bicycle and
Pedestrian Safety
Study**

(September 1999)

**Detailed review of
bicycle and
pedestrian crash
and fatality
information and
trends specific to
North Carolina**

PRELIMINARY

BICYCLE AND PEDESTRIAN

SAFETY WARRANTS

AND POTENTIALLY

HAZARDOUS LOCATIONS



R.J. (Jeff) Jaeger, EI

Traffic Safety Systems Management Unit
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation

September 2000

DRAFT

September 2000

October 2001

North Carolina
Highway Safety Improvement Program

**2001 Supplement:
Bicycle and Pedestrian Warrants**



Traffic Safety Systems Management Unit
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation



October 2001



Crash Frequency

All Crashes	10-15 crashes (top 3-8 percentile) (3 years of data)
Bicycle Crashes	3 crashes (top 2 percentile) (10 years of data)
Pedestrian Crashes	4 crashes (top 2 percentile) (10 years of data)

Analysis/Investigation Types

- 1. Point Location (intersection)**
- 2. Strip Location (section)**
- 3. Corridor Locations (multiple sections/intersections)**
- 4. Cluster Locations**

Pedestrian Crash Types

- 1. Midblock: Dart/Dash**
- 2. Multiple Threat**
- 3. Mailbox or Other Midblock**
- 4. Failure to Yield at Unsignalized Location**
- 5. Bus-Related**
- 6. Turning Vehicle at Intersection**
- 7. Through Vehicle at Intersection**
- 8. Walking Along Roadway**
- 9. Working/Playing in Road**
- 10. Not in Road (sidewalk, driveway, etc.)**
- 11. Backing Vehicle**
- 12. Crossing on Expressway**
- 13. Miscellaneous**

Bicycle Crash Types

- 1. Midblock - Rideout/Driveout**
- 2. Midblock - Wrong Way**
- 3. Midblock - Turning**
- 4. Midblock - Overtaking**
- 5. Midblock - Other**
- 6. Intersection - Rideout/Driveout**
- 7. Right Turn on Red**
- 8. Intersection - Turning**
- 9. Multiple Threat/Trapped**
- 10. Intersection - Other**
- 11. Not in Road**
- 12. Backing Vehicle**
- 13. Miscellaneous**

Investigative Parameters

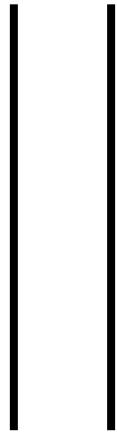
- 1. Pedestrian Speeds**
- 2. Bicyclist Speeds**
- 3. Number of Lanes**
- 4. Crossing Distances**
- 5. Direction of Flow**
- 6. Traffic Control**
- 7. On-Street Parking**
- 8. User Volumes (motorist and non-motorist)**
- 9. Behavior**
- 10. Non-Motorist Networks**
- 11. Visibility**

Investigation Worksheets

- **Location and Investigation Information**
- **Inventory Data**
- **Volume Data**
- **Non-Motorist Level of Service Data**
- **Condition Ratings**



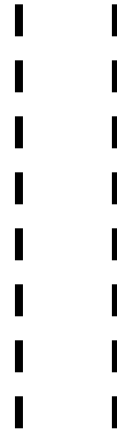
(1)



(2)



(3)



(4)



(5)



(6)

Pedestrian Facilities Users Guide: Providing Safety and Mobility (FHWA-RD-01-102), March 2002



W11-2

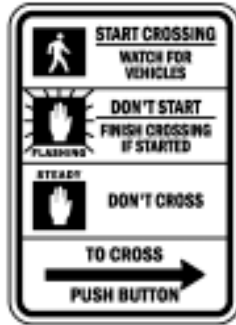


S1-1



R9-10

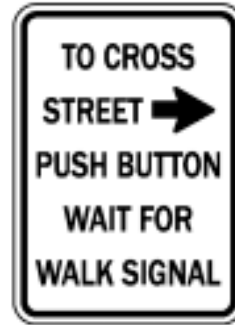
Manual on Uniform Traffic Control Devices (Millennium Edition), FHWA, 2001
Supplement to the Manual on Uniform Traffic Control Devices for Streets and Highways, NCDOT, 1985



R10-3b



R10-4

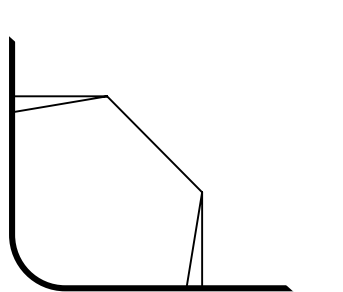


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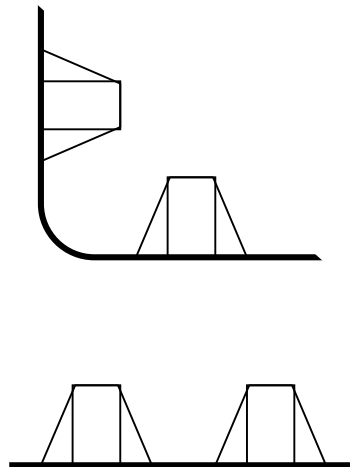


R10-4b

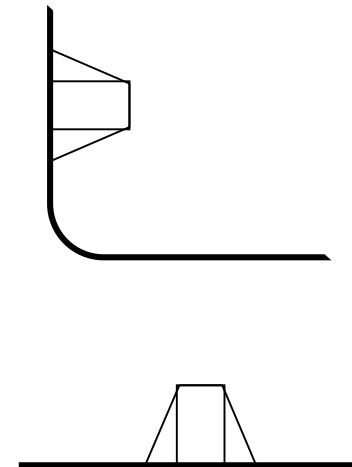
Manual on Uniform Traffic Control Devices (Millennium Edition), FHWA, 2001



(1)



(2)



(3)

Countermeasure Focus Areas

- 1. Exposure and Conflicts**
- 2. Accessibility and Mobility**
- 3. Visibility and Awareness**
- 4. Behavior**

Focus Area 1: Exposure and Conflicts

- **Reduce crossing distances**
- **Improve visibility and actuation**
- **Improve signal timing, phasing, and progression**
- **Reduce quantity and increase spacing of driveways**
- **Evaluate/Install on-street parking**
- **Reduce motor vehicle volumes**
- **Reduce motor vehicle speeds**
- **Increase user channelization**









Focus Area 2: Accessibility and Mobility

- **Improve disability access**
- **Improve/install curb cuts and ramps**
- **Improve surface treatments (non-slip and tactile)**
- **Improve/install sidewalks**
- **Install bicycle lanes**
- **Remove debris**
- **Improve/refresh/replace pavement markings**
- **Improve/complete overall linkage of non-motorist networks**









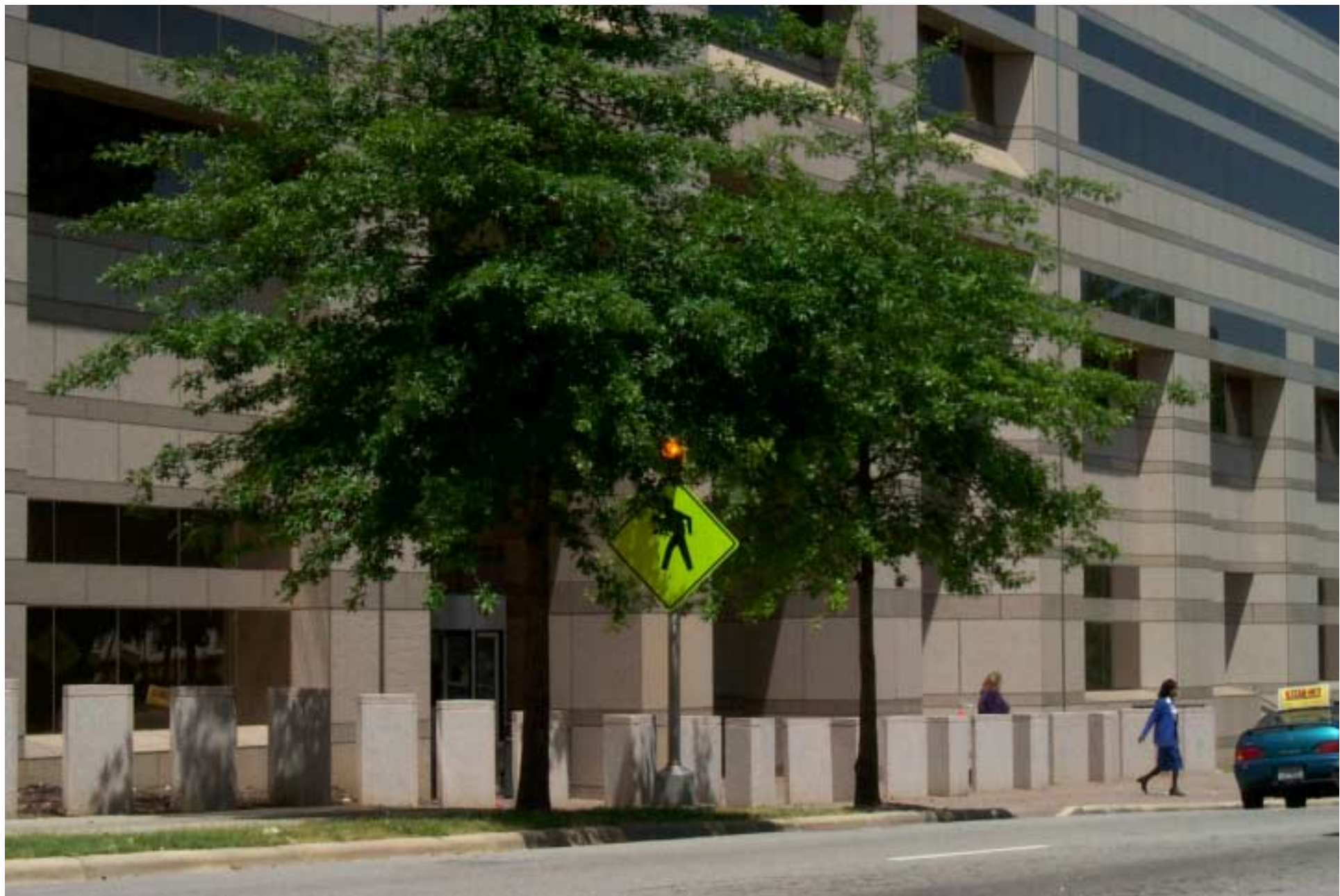




Focus Area 3: Visibility and Awareness

- **Improve/install illumination at crossings and along sidewalks/pathways**
- **Improve/install delineation**
- **Improve/install/upgrade signing**
- **Reduce foliage/vegetation**
- **Increase visibility of crossings**
- **Improve clear zones around crossing terminals**
- **Increase visibility of (and from) driveways**









Focus Area 4: Behavior

- **Improve knowledge and attitudes of coexistence (all users)**
- **Evaluate/improve education initiatives**
- **Reduce unexpected movements**
- **Reduce/eliminate intoxication**
- **Increase overall and targeted enforcement**







Example:

**Hargett Street at Dawson Street
Raleigh, NC**

Hargett Street at Dawson Street

Raleigh, NC

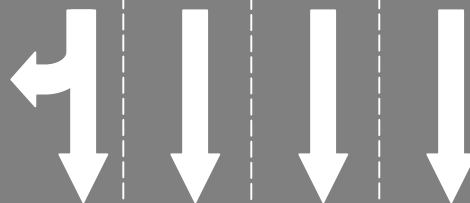


Hargett Street at Dawson Street
Raleigh, NC





**Hargett Street at Dawson Street
Raleigh, NC**



42'

41'




53'

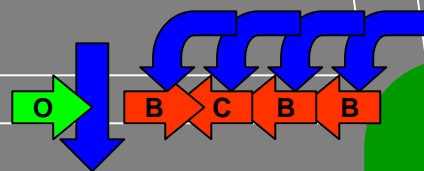
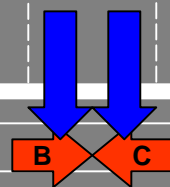
57'



**Current intersection
configuration.**

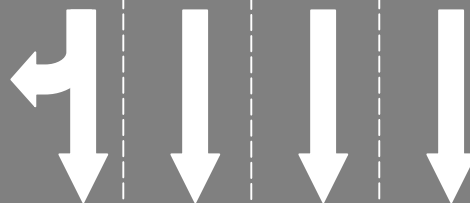
**Hargett Street at Dawson Street
Raleigh, NC**

-  - Motorist
-  - Pedestrian
-  - Bicyclist
- B** - Severity



**Crash history (July 1, 1992
through June 30, 2002).**

**Hargett Street at Dawson Street
Raleigh, NC**



42'

35'

46'

45'



**Possible intersection
configuration improvements.**

Questions?